Efficiency and Stock Price Behaviour of Scheduled Commercial Banks in India: An Analysis

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Chapter 1. Introduction

1.1 Introduction

The scheduled commercial banks dominate the Indian financial system, with much of the financing in the Indian economy taking place through bank loans and commercial banks control a substantial part of the total assets of the financial sector. The banks' transaction processing and settlement services facilitate the individuals and households to invest their savings in financial and tangible assets, paving the way for capital formation in the economy. Over the years, macroeconomic functions have dominated the business objectives of commercial banks in various discussions concerning policymaking, academic research, and the approach of laymen towards the banks. However, commercial banks are business undertakings. As a business undertaking, a commercial bank needs to function, like any other business firm, to attain its corporate objectives guided by the principle of value maximisation to the owners, whether established by the Government or by private owners. A commercial bank should not be considered different from other business entities in this aspect. Commercial banks have a dual role in the economy since there are essential macroeconomic functions that a bank needs to undertake, along with the attainment of its corporate objectives.

The efficient banks will likely survive the economic shocks experienced by a developing economy due to domestic and international economic and political developments better than the inefficient ones and infuse confidence among the public in the banking system. Hence, the efficiency of banks in the country must be studied at regular intervals to get an insight into how efficiently they operate, helping both the managers of the banks and the policymakers in driving the banking industry in the right direction. The importance of the efficiency of banks visualised above leads to the present study on bank efficiency in the Indian context. The efficiency of a bank is a measure of the operational competency of the bank in combining inputs and outputs.

Another method of measuring bank performance that is equally or more important in the case of commercial banks, that are widely held and whose shares are traded in the capital market, is the price at which the bank's ordinary shares are traded, or the stock returns earned by the bank's shareholders. An increase in the stock price adds value to the shareholder and maximising the shareholders' wealth guides the management of a commercial bank, like any other business. The stock price of a bank is intrinsically

linked to the profitability of that bank, and profitability of banks is positively linked to the efficiency of banks. Substantial changes taking place in the structure of the Indian banking sector and the prevailing competitive environment will influence the efficiency of banks and the shareholder value creation by them.

Hence, an analysis of bank efficiency and its relationship with the behaviour of stock prices is of particular importance at the present juncture of the Indian economy. Traditionally accounting performance measures were used to establish the efficiency of firms. Frontier techniques, such as Data Envelopment Analysis, are being considered an alternative and better measure of firm efficiency in the recent literature on firm efficiency, especially in the case of banks.

The present study applies Data Envelopment Analysis technique to estimate the relative efficiency of scheduled commercial banks in India, considering several advantages of the methodology. Using the DEA technique to estimate the relative efficiency of banks in the present study aligns with this observation. In addition, by trying to assess the link between efficiency and stock price behaviour, the present study also verifies the ability of the relative efficiency measurement technique to capture the firm performance with incremental information.

1.2 Literature Review and Research Gap

Over the years efficiency of banks has been a keen interest area for the academic researchers and policy makers. Many studies have explained the influence of ownership of banks, size of banks, and policy and regulatory changes over the efficiency of banks. Studies have also compared the efficiency of banks between the countries that either have similar banking systems or are from different stages of development. Few such studies are Hao, Hunter, and Yang (2001), X. Chen, Skully, and Brown (2005), Casu and Molyneux (2003), Gardener, Molyneux, and Nguyen-Linh (2011), Altunbaş, Gardener, Molyneux, and Moore (2001), T.-Y. Chen and Yeh (2000), Berger, Hasan, and Zhou (2009), Ar and Kurtaran (2013), Altunbas, Evans, and Molyneux (2001), Sathye (2001), Bonin, Hasan, and Wachtel (2005), Fries and Taci (2005), Ariff and Can (2008), Garza-García (2012) in the international context and in the Indian context studies by Arunava Bhattacharyya, Lovell, and Sahay (1997), Ray and Das (2010), Aditi Bhattacharyya and Pal (2013), Jaffry, Ghulam, and Cox (2013), Shaikh, Hongbing, Ishaq, Khan, and Kamal (2015), Mahesh (2006), Sarkar, Sarkar, and

Bhaumik (1998), Sathye (2003), Fujii, Managi, and Matousek (2014), Tzeremes (2015), Sathye (2003), Tzeremes (2015), Kumbhakar and Sarkar (2005), Kamini and Nidhi (2014), Kumbhakar and Sarkar (2003), Bhaumik and Dimova (2004), Sensarma (2006) and Dash and Charles (2009) have presented different results. A few studies have also analysed the link between the efficiency of banks and their stock price behaviour/performance. Such studies are limited worldwide and more so in the Indian context. Some of the studies are Adenso-Díaz and Gascón (1997), Sarkar et al. (1998), Das and Ghosh (2009), Bhaumik and Dimova (2004), Chu and Lim (1998), Kirkwood and Nahm (2005), Sufian and Majid (2007a), Janoudi (2014); Liadaki and Gaganis (2010); Vardar (2013), Ioannidis, Molyneux, and Pasiouras (2008), Eisenbeis, Ferrier, and Kwan (1999), Beccalli, Casu, and Girardone (2006), Sufian and Majid (2007b, 2007c), Cronjé and Beer (2010), Eltivia, Sudarma, Rosidi, and Saraswati (2014), Mishra, Panda, and Mohapatra (2014), Fernández, Gascón, and González (2001), Habibullah, Makmur, Azman-Saini, Radam, and Ong (2005), Sufian and Majid (2009), Pasiouras, Liadaki, and Zopounidis (2008), Gu and Yue (2011), Kasman and Kasman (2011), Mishra, Panda, and Mohapatra (2013), Srairi, Kouki, and Harrathi (2011) and Nagaraju (2013). In the Indian context only Nagaraju (2013), Mishra et al. (2013, 2014), Ioannidis et al. (2008), and Sharma (2018) has tried to analyse the relationship between efficiency of banks and their stock price relationship.

The review of literature relating to efficiency of banks, efficiency of banks and stock performance and the methodological issues in these studies show that, though there are many studies that have analysed efficiency of banks, especially in the Indian context, they do not provide any consensus results. Indian studies on bank efficiency have also failed to provide a comprehensive picture of the banking industry by estimating efficiency using different measures of efficiency in the same period and by using uniform methodology. The studies have also not clearly addressed the methodological issues, discussed in the earlier section, in the Indian context. It can also be noted that the studies have addressed to a great extent the effect of ownership on efficiency but have not linked the same to the shareholder value generation through stock performance or stock price behaviour not only in the Indian context but also globally. Most of the studies have only considered shorter time durations and limited sample size for analysis of the efficiency of banks. Banking market is dynamic and is influenced not only by the

regulatory changes and government policies but also by the constantly changing technological environment.

Hence, there is scope and need for a comprehensive study on bank efficiency and relate the same to the stock market performance of bank stocks especially in the Indian context. Present study is a modest attempt in this direction to add further evidence on the efficiency of banks in India and the relationship between bank efficiency and stock price behaviour. The present study will analyse the efficiency of scheduled commercial banks in India for a twenty year period from 1999-2000 to 2018-2019 by including the population of scheduled commercial banks (and not a sample of banks) and by estimating the efficiency using multiple criteria and two input output specifications, will examine the efficiency differences between the banks in different ownership and size groups, will attempt to identify major determinants of efficiency of banks and probe the relationship between bank efficiency and stock price behaviour of India's listed scheduled commercial banks.

1.3 Objectives of the Study

The theoretical underpinning presented above, and the review of existing literature guides the present study on the efficiency and stock price behaviour of scheduled commercial banks. The objectives of the present study are

1. To estimate the relative efficiency of scheduled commercial banks in India using the Data Envelopment Analysis technique to analyse bank efficiency.
2. To examine the efficiency differences between the banks in different ownership and size groups in the Indian context.
3. To investigate the determinants of bank efficiency in India applying the Tobit regression model.
4. To probe the relationship between bank efficiency and stock price behaviour of India's listed scheduled commercial banks.

1.4 Scope and Period of the Study

The present study focuses on estimating the relative efficiency of scheduled commercial banks in India and linking such estimated bank efficiency scores with their stock price behaviour. The estimation of the relative efficiency of banks is carried out by taking all the scheduled commercial banks that operated in India during the study period, except

for those few banks whose data was not tenable to the application of the Data Envelopment Analysis technique used in the present study. All the scheduled commercial banks listed in the Indian stock market have been considered to link the estimated efficiency scores of the banks with their stock price behaviour. Once again, very few banks had to be omitted due to a lack of relevant data. Relevant data for the twenty years from 1999-2000 to 2018-2019 are considered for the present study.

1.5 Sources of data

The data relating to the stock and flow variables of the banks required for the study are sourced from the Statistical Tables Relating to Banks in India published annually by the Reserve Bank of India. The daily stock price data of listed scheduled commercial banks are gathered from the Prowess database of the Centre for Monitoring Indian Economy (CMIE). Data on macroeconomic variables are sourced from EMIS.

1.6 Methodology and tools

The present study is empirical and adopts DEA, a non-parametric technique, to estimate the relative efficiency of the banks. Tobit regression analysis is used in the identification of the determinants of bank efficiency. The link between estimated efficiency scores and stock price behaviour is established by using panel regression analysis. One-sample t-test, Wilcoxon signed rank test, paired sample t-test, Wilcoxon signed ranks test, Kendall's tau, Mann-Kendall test for the presence of monotonic trend, one way Welch's ANOVA, Games-Howell multiple comparisons, Kruskal-Wallis test and Dunn's post-hoc test are used in the analysis of efficiency of banks. DEA Solver™ Professional Version 15.1 is used for the estimation of the efficiency of banks. R, RStudio, and IBM SPSS Statistics for Windows, Version 26.0 have been used to run the appropriate models for data analysis.

1.7 Limitations

This study concentrates on the efficiency of scheduled commercial banks operating in India during the study period and makes no comparison between different types of banks in India, like cooperative banks and regional rural banks. In addition, the study is in the Indian context, and no comparison of banks operating in different countries has been undertaken. No methodological comparisons have been made in the study, and hence the limitations of adopted methodologies may have their influence on the results of the present study.

1.8 Chapter scheme

The contents of the present study titled Efficiency and Stock Price Behaviour of Scheduled Commercial Banks in India: An Analysis are presented in six chapters. Present chapter one has presented a brief introduction to the study carried out. Chapter two presents an overview of the existing literature in the subject area of the present study. Chapter three provides a conceptual outline of efficiency, outlines the use of frontier techniques in efficiency measurements. It describes the Data Envelopment Analysis technique used in the present study for the estimation of efficiency scores of the banks, describes the Malmquist productivity index, discusses issues in the selection of inputs and outputs of banks for efficiency measurement, and presents the inputs and outputs used in the present study in the process of estimation of the relative efficiency of banks in the present study. Chapter four deals with the empirical examination of the efficiency of scheduled commercial banks in India and identifying the determinants of bank efficiency in India. Chapter five links the efficiency of listed scheduled commercial banks with their stock price behaviour. The final chapter, chapter six, summarises the significant findings of the present study and presents the conclusions drawn from the study.

Chapter 2. Efficiency and Its Measurement – A Conceptual Outline

2.1 Introduction

Efficiency is defined as a condition where it is impossible to produce an additional unit of output with current resources unless one reduces the production of another output. Thus, an efficient firm will lie on the edge of its production capabilities and will be characterised by (a) non-idleness or full employment and (b) using the right amount or non-wastage of resources (Guerrien, 2002). The efficiency of a firm is calculated relative to the production function or production frontier. However, the production frontier is not well defined, especially in the service industry, where engineering information on the technology is not available. Hence, the actual level of efficiency cannot be known for the firms in the service industry, which is the case in the present study analysing the efficiency of scheduled commercial banks in India. To overcome this problem, an empirical production function or frontier will have to be estimated using the observed data from accounting statements, corresponding to output levels achieved for a given input level will be available (Seiford & Thrall, 1990).

Ratio Analysis has been a well-accepted and commonly used method of evaluating banks' bank performance or efficiency by academic researchers and regulators. The shortcomings of Ratio Analysis have led the users to look for alternative methods of performance evaluation (or efficiency measurement) that may overcome the limitations of Ratio Analysis. An alternative that is identified in banking literature is to apply Frontier Analysis Techniques to measure the relative performance of Decision Making Units. Berger and Humphrey (1997) and Balcerzak, Kliestik, Streimikiene, and Smrčka (2017) consider that frontier analysis is one of the most sophisticated methods available to assess DMUs to empirically identify the best practice in the group of DMUs being assessed in the absence of acceptable theoretical best practice or technology of financial institutions. Empirically identified best practice provides the production boundary against which the relative performance of individual DMUs are measured Balcerzak et al. (2017). By using programming or statistical techniques, frontier analysis techniques for the measurement of efficiency of DMUs try to obtain a better efficiency estimation by removing the influence of differences in prices and exogeneous market factors that

affect the performance indicators used in ratio analysis technique making frontier analysis techniques superior to ratio analysis technique (Bauer, Berger, Ferrier, & Humphrey, 1998). Corroborating the superiority of frontier analysis techniques over ratio analysis technique Beccalli et al. (2006) identify that efficiency estimates from frontier analysis techniques have a higher explanatory power compared to performance indicators used in ratio analysis.

Five frontier analysis techniques, grouped under parametric and non-parametric approaches, for the estimation of the best-practice frontier and the efficiency of DMUs, can be identified from the literature.

1. Non-parametric approaches
    a. Data Envelopment Analysis (DEA)
    b. Free Disposal Hull (FDH)
2. Parametric Approaches
    a. Stochastic Frontier Approach (SFA)
    b. Distribution-Free Approach (DFA)
    c. Thick Frontier Approach (TFA)

DEA (a) has several advantages over other existing methodologies, (b) provides a robust estimation of the efficient frontier and therefore efficiency scores of DMUs, and (c) has widespread acceptability of researchers, the present study has adopted Data Envelopment Analysis for the estimation of the efficient frontier and efficiency scores of scheduled commercial banks in India.

2.2 Data Envelopment Analysis

Farrell (1957) established a methodology to measure the efficiency of firms that accounts for multiple inputs. Charnes, Cooper, and Rhodes (1978) extended the methodology and termed it as Data Envelopment Analysis – a non-parametric linear/mathematical programming based technique. DEA measures the efficiency of DMUs in a homogeneous set of empirically observed DMUs by establishing an efficient frontier, representing the technology, consisting of the DMUs that are best performing in the set of DMUs under analysis. Each DMU is assigned an efficiency score according to its distance from the efficient frontier. DMUs that are part of the efficient frontier are efficient with an efficiency score of 1, and the DMUs that are

below the efficient frontier (non-frontier units) carry a certain degree of inefficiency and are assigned an efficiency score below 1 (>0) (Liu et al., 2016; Řepková, 2014).

Charnes et al. (1978) developed the initial DEA model, and it is referred to as Charnes, Cooper, Rhodes Model or CCR Model. The CCR model is developed by defining a production possibility set with the assumption of constant returns to scale (CRS), and hence the DMU being evaluated operates at CRS. The technical efficiency estimates produced by the CCR model is referred to as Overall Technical Efficiency (OTE) or Global Technical Efficiency (GTE). A DMU is said to have technical efficiency if it produces the maximum outputs possible from a given set of inputs or produces the given quantity of outputs with as few inputs as possible (Atkinson & Cornwell, 1994). Hence, the CCR model evaluates the presence of technical inefficiency and scale inefficiency in a DMU simultaneously. If a DMU has either or both inefficiencies, the model will evaluate the DMU as inefficient (Cooper, Seiford, & Tone, 2007). Recognising the possible presence of different returns to scale scenarios among the DMUs belonging to the same production possibility set, the firms in the same industry, Banker, Charnes, and Cooper (1984) proposed a model by relaxing the assumption of CRS in the CCR model. The model is referred to as Banker, Charnes, Cooper model or BCC model. BCC model assesses the efficiency of DMUs under the assumption of Variable Returns to Scale (VRS), thereby recognising that the DMUs being assessed may have increasing returns to scale (IRS), constant returns to scale (CRS), or decreasing returns to scale (DRS) depending on their scale of operation. BCC model, thus, provides an opportunity to estimate technical efficiency devoid of the influence of scale economies allowing the segregation of OTE into pure technical efficiency (PTE) and scale efficiency (SE). Technical efficiency estimated by the BCC model is termed as Pure Technical Efficiency (PTE) and reflects how the productive resources of the DMU are managed. Hence, PTE is also referred to as the managerial efficiency of the DMU. When, for a DMU, OTE and PTE are not equal, it indicates the presence of scale inefficiency. If a DMU operates at an optimal scale, it is said to have scale efficiency (SE). The objective of applying these models is to assess the efficiency of the DMUs in either minimising the use of inputs while retaining the outputs at least at the present level or to maximise the outputs without increasing the use of inputs without considering the influence of the price of inputs and outputs. When the model is estimated with the objective of input minimisation, it is termed an input-oriented DEA

model, and when the model is estimated with the objective of maximisation of outputs, it is termed as output-oriented DEA model (Cooper et al., 2007).

When reliable information of prices of inputs and outputs are available, a DMU can be assessed in terms of its efficiency to minimise cost, maximise revenue or maximise profit. Adoption of price in the calculation of efficiency, thus, results in the estimation of cost efficiency, revenue efficiency and profit efficiency of DMUs. A DMU that can produce a given quantity of output at minimum cost combinations of inputs can be termed as cost efficient. Cost inefficiency could be due to the inability of a DMU to use the most efficient technology or technical inefficiency and/or due to its inability to have a cost minimising input mix or allocative inefficiency. Similarly, revenue efficiency measures the performance of a DMU in generating revenue relative to the best practice bank(s) for producing the same set of outputs. Thus, cost efficiency provides an input perspective, and revenue efficiency provides an output perspective. Profit efficiency considers both cost and revenue performance of DMUs by examining the position of a DMU in terms of profit relative in relation to the best practice DMU(s) for producing the same set of outputs (Kočišová, 2014). Thus, profit efficiency is a more inclusive concept.

2.3 Malmquist Productivity Index

DEA estimations are under static conditions. Seemingly excessive use of resources in one time period may be producing beneficial results or outputs in future periods (Cooper et al., 2007). Window analysis and Malmquist productivity index are dynamic or time-dependent models that help assess efficiency change over time. Efficiency analysis under static conditions coupled with the analysis of efficiency change over time will provide a better understanding of the Indian banking sector's efficiency. The present study uses the Malmquist productivity index introduced by Malmquist (1953) and further developed by Caves, Christensen, and Diewert (1982); Färe and Grosskopf (1992); Färe, Grosskopf, Lindgren, and Roos (1994); Färe, Grosskopf, and Russell (1998); Thrall (2000) among others. The Malmquist index provides an evaluation of the productivity change of a DMU between two time periods.

2.4 Selection of Input and Output

As evident from the discussions in the previous section, to estimate the relative efficiency of DMUs, scheduled commercial banks in the present study, inputs and

outputs of the production process must be identified. However, there is disagreement over the services produced by the banks and how they can be measured effectively. Commercial Banks jointly produce a host of financial services by using common inputs, for which pricing is done in bundles rather than individually, making the identification of inputs and outputs of the banks tedious. The literature on the efficiency of banks has used different approaches – Production approach, intermediation approach, asset approach, user cost approach, value-added approach, and operating approach – to the identification of inputs and outputs of banking organisations. These approaches are the result of different models used for explaining the behaviour of banks.

Table 2.1: Input and Output Variables and their associated prices.

Models	Inputs	Input Cost	Outputs	Output Price
Model A	Average Fixed Assets	NA	Average Investments	NA
	Average Total Deposits	NA	Average Advances	NA
	Average Borrowings	NA	Non-Interest Income	NA
	Number of Employees	NA		
	Operating Expenses (Excluding Employee Expenses)	NA		
Model B	Average Fixed Assets	NA	Income From Investments	NA
	Average Total Deposits	NA	Net Interest Income	NA
	Average Borrowings	NA	Non-Interest Income	NA
	Number of Employees	NA		
	Operating Expenses (Excluding Employee Expenses)	NA		
Model C	Average Total Deposits	Interest Expenses on Deposits Divided by Average Total Deposits	Average Total Investments	Income From Investments Divided by Average Total Investments

Average Borrowings	Interest Expenses on Borrowings Divided by Average Borrowings	Average Net Total Advances (Total Advances Minus Non-Performing Assets)	Interest Income from Advances Divided by Average Net Total Advances
Average Fixed Assets	Operating Expenses (Excluding Employee Expenses) Divided by Average Fixed Assets	Non-Interest Income	1
Number of Employees	Payments and Provisions for Employees Divided by the Number of Employees		NA

Source: Author's compilation

Table 3.1 presents the inputs and outputs used in the present study in the estimation of bank efficiency. The selection of inputs and outputs in the present study is guided by the approaches presented above. However, no specific approach from above has been used in the identification of the inputs and outputs of the banks. The two models used in the estimation of CCR and BCC models have common inputs. The inputs used have the characteristics of production approach, intermediation approach, asset approach, and operating approach. The two models differ in the output specification. The first model, Model A, can be recognised as an asset-based model. Model B, the second model, can be recognised as an income-based model. The inputs, outputs and their associated price used in the estimation of cost efficiency, revenue efficiency, and profit efficiency are denoted by Model C in the table.

Chapter 3. Empirical Examination of Efficiency of Scheduled Commercial Banks in India

3.1 Introduction

The efficiency of banks in India has received considerable attention from researchers. However, the existing literature has a consensus opinion that the efficiency estimations vary across periods, methodologies and are subject to the variables used in the estimation. The present study makes a modest attempt to estimate the relative efficiency of scheduled commercial banks (SCBs) in India using Data Envelopment Analysis (DEA), a non-parametric frontier technique, to analyse bank efficiency over twenty years from 1999 – 2000 to 2018 – 2019. The methodology enables the estimation of Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE), Scale Efficiency (SE), Cost Efficiency (CE), Revenue Efficiency (RE), and Profit Efficiency (PE) of SCBs in India. The present study differs from the existing literature in that (a) all six efficiency measures are estimated for the same set of banks with comparable input and output specifications, and (b) all SCBs operating in India during the study period have been considered in the analysis. Hence, the efficiency analysis presented in this study will provide a holistic view of the efficiency of SCBs in India.

3.2 Empirical Results

3.2.1 Overall Technical, Pure Technical and Scale Efficiency

OTE, PTE, and SE scores of all 127 SCBs operating in India during the study period, 1999-2000 to 2018-2019, are estimated year-wise. 60 banks out of the 127 banks were operational in all years of the study period. As mentioned already, banking activity is approximated with two models – Model A: Asset Based Model and Model B: Income Based Model.

Hypothesis 1: *The scheduled commercial banks in India are efficient*
Hypothesis 2: *The efficiency estimates do not significantly differ between Model A and Model B*

Hypothesis 1 is tested using one-sample t-test and Wilcoxon signed rank test individually on the distribution of three efficiency scores from both Model A and Model B. The results from both the tests show that the OTE, PTE, and SE of SCBs in India

are statistically significantly below one, at the 5% level of significance, under both Model A and Model B. Thus, the results support the rejection of hypothesis 1, and it is concluded that inefficiencies were present in India's SCBs during the study period.

Hypothesis 2 is tested by using paired sample t-test and Wilcoxon signed ranks test by taking the pairs of three efficiency scores estimated for Model A and Model B and by using a correlation analysis using Kendall's tau (τ) coefficient. The results of paired t-test, Wilcoxon signed ranks test, and correlation analysis using Kendall's tau (τ) coefficient clearly indicate that efficiency estimates corresponding to Model A and Model B are different and hypothesis 2 can be rejected. Relating the results of statistical tests and the output specification of the models it is inferred that banks are more efficient when their efficiency is measured in terms of generating earning assets and they are less efficient when the efficiency is measured in terms of generating income from the same set of inputs. In other words, banks are relatively more efficient in converting deposits and borrowings into investments and advances than they are in converting them into income.

Hypothesis 3: *There is no significant difference between pure technical efficiency and scale efficiency of banks*

Paired t-test and Wilcoxon signed ranks test are used to test the hypothesis 3. Statistically significant difference is observed between PTE and SE scores of both Model A and Model B, at 5% level of significance. The results prove that PTE of SCBs is lower than their SE. In other words, results prove that managerial inefficiency is higher than scale inefficiency, and hypothesis 3 is rejected.

Hypothesis 4: *There is no significant monotonic trend in the efficiency scores of SCBs in India.*

Following the above results showing the presence of inefficiency among the SCBs in India and identification of managerial inefficiency to be an important cause of bank inefficiency, Mann-Kendall test is used to statistically test the presence of monotonic trend in the efficiency scores of SCBs in India over the study period. Mann-Kendall test coefficients are observed to be negative for majority of the banks, for all the three efficiency estimates under both Model A and Model B, indicating that there existed downward trend in the efficiency of banks during the study period.

Thus, the results clearly show (a) the presence of inefficiency among the SCBs in India, (b) that efficiency scores are dependent on the specification of input and output variables in the estimation of efficiency scores, (c) that the SCBs are less efficient in income generation than asset creation, (d) that managerial inefficiency is more pronounced than the scale inefficiency, and (e) the presence of a downward trend in the efficiency of banks, in general, during the study period. The results of the present study are in alignment with the existing literature and confirms that there exists inefficiency among the SCBs in India and extends the conclusion and presents the presence of downward trend in the efficiency of banks in India.

Hypothesis 5: *There is no significant change in the efficiency of SCBs in India during the study period*

Hypothesis 5 was tested using a one-sample t-test and Wilcoxon signed rank test, separately for Model A and B, with hypothesised mean/median equal to one. The non-parametric statistical investigation of TEC and PTEC offers sufficient evidence to reject hypothesis 5 at 5% level of significance and it can be concluded that technical and pure technical efficiencies of banks regressed during the study period. However, there is no statistical evidence for change in scale efficiency of banks.

Hypothesis 6: *There is no significant frontier shift or technological progress in the SCBs during the study period*

Both one-sample t-test and Wilcoxon signed rank test report a statistically significant frontier shift during the study period at 5% level of significance under both Model A and Model B. Hence, hypothesis 6 is rejected and it is concluded that SCBs have progressed technologically during the study period.

Technological progress will result in the efficiency frontier shifting away from the inefficient banks resulting in regress in their relative efficiency unless they exhibit strong effort towards catching-up with the efficiency frontier. Since, there is sufficient evidence of frontier shift and regress in technical and pure technical efficiency of banks, it is evident that banks have been successful in adopting new technologies in their banking operations, but the inefficient banks have not been able to catch-up with their efficient peers. Hence, the technological progress has not helped the inefficient banks in their catching-up process which can be attributed to the managerial inefficiency of

these banks since there is no statistical evidence of negative SEC during the study period.

Hypothesis 7: *There is no significant change in the factor productivity of SCBs in India during the study period*

The hypothesis 7 is tested using the one-sample t-test and Wilcoxon signed rank test. The results show that there is statistically significant MTFPC during the study period at 5% level of significance under both Model A and Model B. Hypothesis 7 is, hence, rejected and it can be concluded that the SCBs have improved their total factor productivity during the study period. However, since efficiency of banks regressed during the study period, the improvement in total factor productivity is a result of banks having technological progress. Banks could have had higher factor productivity if they could improve their operational efficiency.

Hypothesis 8: *The estimates of Malmquist index do not significantly differ between Model A and Model B*

Hypothesis 8 is tested by using paired sample t-test and Wilcoxon signed ranks test by taking the pairs of TEC, PTEC, FS, and MTFPC estimated for Model A and Model B. The results show that there is no significant difference in the estimates of TEC, PTEC, and SEC. Hence, hypothesis 8 cannot be rejected in the case of TEC, PTEC, and SEC estimates and it can be concluded that efficiency change in the SCBs in their asset creation and income generation processes do not differ significantly during the study period at 5% level of significance. However, the paired t-test results show that MTFPC differs significantly at 5% level of significance between the two models, but FS does not. But Wilcoxon signed ranks test suggests that both FS and MTFPC differ significantly at 5% level of significance between the two models. Also, according to to the results of paired sample t-test MTFPC from Model A is significantly higher lower than that from Model B but the Wilcoxon signed rank test suggests that both FS and MTFPC is higher from Model A compared to Model B contradicting the results of paired sample t-test. However, hypothesis 8 is rejected in the case of FS and MTFPC indices based on the Wilcoxon signed ranks test and it can be concluded that larger technological process has taken place during the study period in the asset creation process of the SCBs increasing their factor productivity.

Hypothesis 9: *The efficiency of banks in different ownership groups do not differ significantly*

Hypothesis 9 is tested using one-way Welch's ANOVA and Kruskal-Wallis test separately for the three efficiency measures and for Model A and B. The results clearly show that the efficiency of banks differ between ownership groups although the differences are not statistically significant between the groups for all efficiency measurements and for output specifications. Nevertheless, hypothesis 9 can be rejected and it can be inferred that there exists difference in efficiency between the bank ownership groups. No significant differences are observed between the State Bank of India group banks and public sector Indian banks, it can be inferred that all the banks wherein Government own the majority stake have similar efficiency levels.

Hypothesis 10: *The efficiency of SCBs does not differ significantly between the size groups during the study period*

Hypothesis 10 is tested using one-way Welch's ANOVA and Kruskal-Wallis test separately for the three efficiency measures and for Model A and B. Fairly similar results are observed from Model A and Model B w.r.t. OTE and PTE that larger banks have superior technical and managerial efficiencies in both asset creation and income generation processes. Hence, larger banks are more suitable in the Indian context. Conclusive statistical results are not observed for SE.

3.2.2 Cost Efficiency, Revenue Efficiency, and Profit Efficiency

Like OTE, PTE, and SE, Cost, Revenue and Profit efficiencies of all SCBs were estimated for the study period.

Hypothesis 11: *The scheduled commercial banks in India are cost, revenue, and profit efficient.*
Hypothesis 12: *There is no significant difference between cost, revenue, and profit efficiencies of banks*

Hypothesis 11 is tested using one-sample t-test and Wilcoxon signed rank test. The test statistics are statistically significant at 1% level of significance and the results show that inefficiencies are present in the SCBs. Hence, hypothesis 11 can be rejected and it can be concluded that banks in India are cost, revenue and profit inefficient.

To test hypothesis 12, paired t-test and Wilcoxon signed ranks test were run and the results are presented in Table 4.18. The results from both the tests suggest that the difference between CE and RE and between CE and PE are statistically significantly different at 1% level of significance. However, only Wilcoxon signed ranks test results show that the difference between RE and PE are statistically significant at 1% level of significance. The results, further, reveal that the CE of SCBs is significantly lower than their RE and PE indicating that SCBs have significantly higher cost inefficiency than revenue and profit inefficiencies. Following the results of Wilcoxon signed ranks test it can be concluded that RE of SCBs is lower than their PE. Hence, hypothesis 12 is rejected.

Hypothesis 13: *There is no significant monotonic trend in the cost, revenue, and profit efficiency scores of SCBs in India.*

Mann-Kendall test coefficients are observed to be negative for majority of the banks, for all the three efficiency estimates indicating that there existed downward trend in the cost, revenue, and profit efficiency of banks during the study period like in the case of OTE, PTE, and SE scores during the study period. However, larger proportion of trend coefficients are not found to be statistically significant either at 1% or 5% level of significance. Hence, there is no sufficient evidence to reject the hypothesis 13 in the case of majority of the banks and it is concluded that though there existed a downward trend, in general, in the cost, revenue, and profit efficiencies of SCBs during the study period, the downward trend is not significant in majority of the SCBs.

Hypothesis 14: *The cost, revenue and profit efficiencies of banks do not significantly differ between the ownership groups during the study period*

Hypothesis 15: *The cost, revenue and profit efficiencies of banks do not significantly differ between the size groups during the study period*

One-way Welch's ANOVA and Kruskal-Wallis test are used to test the above two hypotheses. The difference in CE of SCBs between different ownership groups do not significantly differ at 5% level of significance. However, significant difference between bank ownership groups is observed in their RE and PE. Among the Indian banks, RE of banks are influenced little by their ownership, whether public or private. In contrast to CE and RE, public sector Indian banks had highest PE during the study period

followed by State Bank of India group banks, Indian private sector banks and foreign banks in India respectively. It can be observed that though the foreign banks in India have higher CE and RE, their PE is least.

On grouping the banks according to their size, the difference in CE between large and small, large and medium, very large and small, very large and medium, and very large and large size SCBs are statistically significantly differ at 1% level of significance proving that CE of SCBs increase with size. The RE of very large banks is found to be higher than large, medium, and small banks at 1% level of significance. The results suggest that large and very large banks have higher PE than medium and small size banks indicating that larger banks have higher PE. The statistical investigation provides sufficient evidence to reject the hypothesis 15 and conclude that the CE, RE, and PE of the SCBs in different size groups differ significantly.

3.2.3 Efficient frontier and ranking of banks

On ranking of banks according to their efficiency scores, it can be observed that the ranking of banks varied across different years in the study period. The ranking of SCBs for the study period shows that FBI01, FBI07, FBI33, FBI09, FBI48, IPSB35, IPSB16, FBI37, PSIB18, and IPSB27 are the top ten banks respectively for the study period. It can be observed that top five banks are foreign banks in India, sixth and seventh ranked banks are Indian private sector banks, eighth ranked bank is a foreign bank in India, ninth ranked bank is a public sector Indian bank, and tenth ranked bank is an Indian private sector bank. Among the Indian banks, IPSB35, IPSB16, PSIB18, IPSB27, PSIB12, IPSB32, IPSB26, PSIB13, PSIB01, and PSIB02 are the top ten banks. Thus, five Indian private sector banks and five public sector Indian banks feature in the top ten Indian banks.

3.2.4 Determinants of Efficiency

The estimated efficiency scores using data envelopment analysis are censored and range between zero and one. The most common practice in the literature on bank efficiency studies is to use Tobit regression model (Tobin, 1958), a censored regression model, in the post-efficiency analysis to determine the Determinants of Efficiency.

Through the regression analysis, it is found that (a) the OTE and PTE of banks are determined by the year-on-year change in the consumer price index, market power,

capitalisation of banks, size of the banks, and liquidity of the banks. Influence of year-on-year change in the Gross Domestic Product and ownership of the banks depends on the output specification used in the estimation of efficiency of banks, (b) the CE of banks is determined by the market power, capitalisation of banks, ownership of the banks and size of the banks, (c) the RE of banks is determined by the year-on-year change in the consumer price index, year-on-year change in the Gross Domestic Product, market power, ownership (private sector or public sector ownership), and size of the banks, and (d) the PE of banks is determined by the year-on-year change in the Gross Domestic Product, market power, ownership (Indian bank or foreign banks in India), size of the bank, liquidity of the bank, and bank asset quality.

3.3 Conclusion

The analysis of the efficiency of SCBs presented in the chapter shows that during the study period from 1999-2000 to 2018-2019, SCBs in India experienced inefficiency in their operations. It is observed that the efficiency scores of banks differ depending on the specification of inputs and outputs of the banks confirming the reports from the existing literature. SCBs in India show poor efficiency in identifying the assets that will generate income effectively, indicating that the banks have managerial inefficiency. The present study also shows that the CE of banks in India is significantly lower than RE and PE. There is no significant difference between RE and PE, though PE is lower than RE. The analysis of efficiency changes over time using MI has shown that there is little progress in the efficiency of banks during the study period indicating little catching up by the inefficient banks with their efficient peers. However, the study period is characterised by the technological progress in SCBs, and their factor productivity also showed considerable improvement. Unlike the efficiency scores, the efficiency change over time does not significantly differ between the specification of inputs and outputs. However, the total factor productivity change index differs between the two models. The factor productivity change estimated from Model B is higher than Model A. Efficiency comparisons between the banks in four ownership groups reveal that banks' efficiency differs between the ownership groups in terms of their OTE, PTE, SE, RE, and PE. However, some of the paired differences are not significant statistically and the CE of banks does not differ between the ownership groups. Banks in the public sector (public sector Indian banks and State Bank of India group banks) have the edge over the banks in the private sector (foreign banks in India and Indian private sector banks)

in terms of their operating efficiency. However, foreign banks in India form the reference set for the banks in India as a more significant proportion of foreign banks form part of the efficiency frontier than their Indian counterparts. Ranking of banks also shows that top five SCBs are from among the foreign banks in India. Based on the size, it is observed that the efficiency of banks improves with size except for the scale efficiency of banks. The Tobit regression analysis shows that year-on-year change in the consumer price index, year-on-year change in the Gross Domestic Product, market power, capitalisation of banks, size of the banks, liquidity of the banks, and bank ownership influence the efficiency of banks. Bank asset quality is of specific importance for the PE of banks.

Chapter 4. Efficiency and Stock Price Behaviour

4.1 Introduction

In a semi-strong efficient market, it is assumed that all relevant publicly available information is incorporated into the asset price. The measures of bank efficiency use the publicly available information to estimate the relative efficiency of banks. The value of efficiency of banks to the shareholders can, therefore, be inferred from the stock market performance of their stocks. It can be hypothesised that efficient banks will add wealth to their shareholders through superior financial performance in the future. These expectations will be reflected in the stock price behaviour. Hence, the stock returns of efficient banks are likely to be higher than that of inefficient banks. Even though bank efficiency is valuable, only the distinctive efficiency factors will be relevant in asset pricing and may be visible in stock performance.

The present study is an attempt to examine the link between relative efficiency of banks in India and their stock price behaviour in the light of the theoretical underpinning presented above.

4.2 Methodology and Results

Daily returns of each bank's stock and market indices were calculated from the daily adjusted closing prices by applying the logarithmic approximation. Monthly returns are then estimated by adding the daily returns of twenty-one trading days. Twelve monthly returns are estimated following the announcement of year-end financial results by the banks without overlapping with the next announcement of year-end financial results.

The present study adopts both period over period change in the efficiency of banks at time $t-1$ and contemporaneous efficiency of banks, efficiency score of the banks at time *t*, in a regression model to analyse the link between the efficiency of banks in India and their stock price behaviour. Period over period change in the efficiency of banks in time $t-1$ will control the influence of the prior period efficiency change of the banks while establishing the link between efficiency of banks and their stock price behaviour. The regression model is presented in equation below.

$$\Delta R_{it} = \alpha + \beta_1 \Delta R_{mt} + \beta_2 \Delta R_{st} + \beta_3 \Delta EPS_{it-1} + \beta_4 EPS_{it} + \beta_5 \Delta E_{it-1} + \beta_6 E_{it} + \varepsilon_{it}$$

where,

ΔR_{it}= Period over period change in the return of bank *i* at time *t.*

ΔR_{mt}= Period over period change in the market return at time *t.*

ΔR_{st}= Period over period change in the sectoral index return at time t.

ΔEPS_{it-1}= Period over period change in the earnings per share of bank *i* at time *t-1*.

EPS_{it} = Earnings per share of bank *i* at time *t.*

ΔE_{it-1}= Period over period change in the efficiency of bank *i* at time *t-1*.

E_{it}= Relative efficiency of bank *i* at time *t.*

$\alpha, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, and\ \beta_6$ are the parameters of the models

ε_{it} = Error term of the model

The model tries to establish the link between the efficiency of banks and their stock price behaviour by controlling the effects of period over period change in the market return, period over period change in the sectoral index return, period over period change in the earnings per share of the banks at time $t-1$ and their contemporaneous earnings per share, earnings per share at time *t*.

The regression equation presented above is estimated for twelve monthly intervals and for the financial year. Since nine efficiency estimates are used, for each time interval nine estimations of the equation are carried out. The results will help in identifying the most valuable efficiency criteria in creation of wealth to the shareholders. In addition, the monthly estimates will provide insights into if the link between the efficiency scores and stock price behaviour are consistently present across different time intervals. Since the listed scheduled commercial banks in India are observed across years in the present study, the pooled ordinary least squares estimation of the equation will tend to be biased in the presence of panel effect. The results of Breusch-Pagan Lagrange Multiplier test (Breusch & Pagan, 1980) and Hausman test (Hausman, 1978) suggested that random

effects model is more appropriate than the fixed effects model. Hence, the equation is estimated using the random effects model. Estimations were made using *plm* package for R (Croissant & Millo, 2008, 2018) with *vcovHC* function for estimating robust standard errors that are autocorrelation and heteroskedasticity corrected according to the White method (Arellano, 1987; White, 1980, 1984).

The panel regression analysis clearly show that there exists a link between efficiency of banks and their stock price behaviour. However, all the efficiency estimates used in the analysis do not have same level of influence on the stock price behaviour. It is also observed that input and output specification in the efficiency model has a bearing on the usefulness of the information provided by the efficiency scores. Overall technical and pure technical efficiencies over stock price behaviour have an influence on the stock price behaviour of the banks with the estimates from Model B showing higher influence than that from Model A. On the other hand, the influence of scale efficiency of banks from Model A is found to have greater influence on the stock price behaviour than that from Model B. Cost and revenue efficiencies of the banks have significant influence on their stock price behaviour. However, the influence of profit efficiency is limited. It is observed that the influence of the efficiency scores on stock price behaviour varies across the year following the announcement of financial results by the banks and significant influence is observed intermittently. Scale efficiency of banks in their asset creation process (Model A), cost efficiency of banks, and revenue efficiency of banks are identified as the efficiency criteria that are important from the perspective of shareholder value creation. A bank that operates at higher level of scale efficiency in asset creation process with higher levels of cost and revenue efficiency will positively influence its stock price and generate higher value to its shareholders. The result of the present study is consistent with the results of similar studies internationally.

Chapter 5. Findings and Conclusion

5.1 Findings

1. Inefficiencies are present in the SCBs in India.
2. Higher inefficiency in income generation process of banks than in asset creation is observed.
3. It is found that there is pronounced managerial inefficiency than scale inefficiency in SCBs in India.
4. It is found that SCBs in India have higher cost inefficiency than revenue and profit inefficiencies.
5. There is downward trend in the efficiency of SCBs in India.
6. Technological progress took place during the study period.
7. Improvement in the total factor productivity of SCBs took place during the study period.
8. Public sector Indian banks have higher relative efficiency than Indian private sector banks while foreign banks in India have highest relative efficiency.
9. Larger banks have higher relative efficiency in India,
10. The top 10 SCBs in India are FBI01, FBI07, FBI33, FBI09, FBI48, IPSB35, IPSB16, FBI37, PSIB18, and IPSB27. Among the Indian banks, IPSB35, IPSB16, PSIB18, IPSB27, PSIB12, IPSB32, IPSB26, PSIB13, PSIB01, and PSIB02 are the top ten banks.
11. Determinants of bank efficiency: (a) the OTE, and PTE of banks are determined by the year-on-year change in the consumer price index, market power, capitalisation of banks, size of the banks, and liquidity of the banks. Influence of year-on-year change in the Gross Domestic Product and ownership of the banks depends on the output specification used in the estimation of efficiency of banks, (b) the CE of banks is determined by the market power, capitalisation of banks, ownership of the banks and size of the banks, (c) the RE of banks is determined by the year-on-year change in the consumer price index, year-on-year change in the Gross Domestic Product, market power, ownership (private sector or public sector ownership), and size of the banks, and (d) the PE of banks is determined by the year-on-year change in the Gross Domestic Product, market power, ownership (Indian bank or foreign banks in India), size of the bank, liquidity of the bank, and bank asset quality.

12. Efficiency and stock price behaviour: It is observed that the relative efficiency scores estimated for the SCBs in India, except profit efficiency, have a significant positive influence over the period over period change in the stock returns of the banks. The results, hence, clearly suggest that there exists a link between efficiency of banks and their stock price behaviour and it can be concluded that the efficient SCBs add value to their shareholders through their superior operational performance. The results also show that the efficiency of the banks in their income generation process is more relevant than the asset creation process. On inclusion of price of inputs and outputs of the SCBs in efficiency estimation, it is observed that cost and revenue efficiencies of banks influence the price behaviour of their stocks. The influence of profit efficiency is not pronounced. The SCBs need to be cost and revenue efficient to add value to their shareholders.

    Among all the efficiency estimates adopted in the study, overall technical efficiency and scale efficiency of SCBs from Model A, cost efficiency and revenue efficiency of SCBs are most important influencers of stock price behaviour. More specifically scale efficiency of SCBs in asset creation process (Model A), their cost efficiency and revenue efficiency are the most relevant efficiency criteria in explaining the stock price behaviour. Hence, a bank with superior scale, cost and revenue efficiency can be expected to add higher value to its shareholders. As observed earlier, cost inefficiency is higher among the SCBs in India. It is important that they concentrate on reducing cost inefficiencies to provide superior value to their shareholders by positively influencing their stock price.

    Overall, the results suggest that the contemporaneous relative efficiency of banks is reflected in their stock price behaviour and the banks with superior operational efficiency create higher value to their shareholders. Nevertheless, general market trend has a very high influence over the stock price behaviour of the banks.

5.2 Conclusion

The present study estimated the relative efficiency of SCBs in India and probed into the relationship between the efficiency of banks and their stock price behaviour. The results clearly indicated that (a) SCBs in India are characterised with the presence of inefficiency in their operating performance, (b) SCBs have higher inefficiency in income generation process than in asset creation, (c) higher level of managerial inefficiency and cost inefficiency is observed among the SCBs in India, (d) during the study period though the total factor productivity of banks improved due to technological progress, operational efficiency of banks declined, (e) public sector banks and larger banks have superior relative efficiency in India while foreign banks in India have higher relative efficiency than the Indian banks, (f) efficiency of banks influence the stock price behaviour of the banks. Banks with higher relative efficiency add value to their shareholders, and (g) scale efficiency of SCBs in their asset creation process, their cost efficiency and revenue efficiency provide most useful information to the shareholders and the stock price behaviour reflects the information contemporaneously. It can be, therefore, concluded that SCBs in India must adopt strategies to improve their operational performance and in the Indian context, larger public sector banks are likely to be more valuable to the economy.

5.3 Suggestions for further research

The present study adopted non-parametric Data Envelopment Analysis technique too estimate the relative efficiency of banks with output-oriented approach. Further research can be carried out (a) by estimating the efficiency of banks using competing methodologies like Stochastic Frontier Analysis, (b) with alternative input output specifications, and (c) with input-oriented approach to gain further insights into the efficiency of banks in India. The present study has also restricted the analysis to the SCBs in India. Further studies on bank efficiency are possible in cooperative banking sector in India and efficiency of SCBs and cooperative banks can be compared. The present study has probed into the relationship between the efficiency of banks and their stock price behaviour. Further studies can be undertaken with other service and industrial sectors and a model explaining the relationship between firm efficiency and stock price behaviour can be built.

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Appendix

List of Scheduled Commercial Banks and their code names

DMU Name/Coding	Bank	Ownership Category	Listing Status
FBI01	AB Bank Limited	Foreign Banks in India	Non-Listed
FBI02	Abu Dhabi Commercial Bank PJSC	Foreign Banks in India	Non-Listed
FBI03	American Express Bank	Foreign Banks in India	Non-Listed
FBI04	American Express Banking Corp.	Foreign Banks in India	Non-Listed
FBI05	Australia and New Zealand Banking Group Limited	Foreign Banks in India	Non-Listed
FBI06	Bank Muscat (S.A.O.G.)	Foreign Banks in India	Non-Listed
FBI07	Bank of America N A	Foreign Banks in India	Non-Listed
FBI08	Bank of Bahrain and Kuwait B.S.C.	Foreign Banks in India	Non-Listed
FBI09	Bank of Ceylon	Foreign Banks in India	Non-Listed
FBI10	Bank of Nova Scotia	Foreign Banks in India	Non-Listed
FBI11	Barclays Bank P L C	Foreign Banks in India	Non-Listed
FBI12	BNP Paribas	Foreign Banks in India	Non-Listed
FBI13	Chase Manhattan Bank	Foreign Banks in India	Non-Listed
FBI14	Citibank N. A.	Foreign Banks in India	Non-Listed
FBI15	Commerz Bank	Foreign Banks in India	Non-Listed
FBI16	Commonwealth Bank of Australia	Foreign Banks in India	Non-Listed
FBI17	Coöperatieve Rabobank U.A.	Foreign Banks in India	Non-Listed
FBI18	Credit Agricole Corporate and Investment Bank	Foreign Banks in India	Non-Listed
FBI19	Credit Lyonnais	Foreign Banks in India	Non-Listed
FBI20	Credit Suisse A.G	Foreign Banks in India	Non-Listed
FBI21	CTBC Bank Co. Ltd.	Foreign Banks in India	Non-Listed
FBI22	DBS Bank Ltd	Foreign Banks in India	Non-Listed
FBI23	Deutsche Bank A G	Foreign Banks in India	Non-Listed
FBI24	Doha Bank Q.P.S.C	Foreign Banks in India	Non-Listed
FBI25	Dresdner Bank	Foreign Banks in India	Non-Listed

DMU Name/Coding	Bank	Ownership Category	Listing Status
FBI26	Emirates NBD Bank (P.J.S.C)	Foreign Banks in India	Non-Listed
FBI27	First Rand Bank Ltd	Foreign Banks in India	Non-Listed
FBI28	Grindlays Bank	Foreign Banks in India	Non-Listed
FBI29	HSBC Bank Oman S.A.O.G	Foreign Banks in India	Non-Listed
FBI30	Industrial and Commercial Bank of China Limited	Foreign Banks in India	Non-Listed
FBI31	Industrial Bank of Korea	Foreign Banks in India	Non-Listed
FBI32	ING Bank	Foreign Banks in India	Non-Listed
FBI33	JP Morgan Chase Bank, National Association	Foreign Banks in India	Non-Listed
FBI34	KBC Bank N.V.	Foreign Banks in India	Non-Listed
FBI35	KEB Hana Bank	Foreign Banks in India	Non-Listed
FBI36	Krung Thai Bank Public Company Limited	Foreign Banks in India	Non-Listed
FBI37	Mashreq Bank PSC	Foreign Banks in India	Non-Listed
FBI38	Mizuho Bank Ltd.	Foreign Banks in India	Non-Listed
FBI39	Morgan Guaranty Trust	Foreign Banks in India	Non-Listed
FBI40	MUFG Bank Limited	Foreign Banks in India	Non-Listed
FBI41	National Australia Bank	Foreign Banks in India	Non-Listed
FBI42	Qatar National Bank (Q.P.S.C.)	Foreign Banks in India	Non-Listed
FBI43	Sberbank	Foreign Banks in India	Non-Listed
FBI44	SBM Bank (Mauritius) Ltd	Foreign Banks in India	Non-Listed
FBI45	Shinhan Bank	Foreign Banks in India	Non-Listed
FBI46	Siam Commercial Bank	Foreign Banks in India	Non-Listed
FBI47	Societe Generale	Foreign Banks in India	Non-Listed
FBI48	Sonali Bank	Foreign Banks in India	Non-Listed
FBI49	Standard Chartered Bank	Foreign Banks in India	Non-Listed
FBI50	Sumitomo Mitsui Banking Corporation	Foreign Banks in India	Non-Listed
FBI51	The Bank of Tokyo - Mitsubishi Ltd.	Foreign Banks in India	Non-Listed
FBI52	The Hongkong and Shanghai Banking Corporation Limited	Foreign Banks in India	Non-Listed

DMU Name/Coding	Bank	Ownership Category	Listing Status
FBI53	The Oversea – Chinese Banking Corporation Limited	Foreign Banks in India	Non-Listed
FBI54	The Royal Bank of Scotland N.V.	Foreign Banks in India	Non-Listed
FBI55	The Sakura Bank	Foreign Banks in India	Non-Listed
FBI56	The Sumitomo Bank Limited	Foreign Banks in India	Non-Listed
FBI57	UBS AG	Foreign Banks in India	Non-Listed
FBI58	UFJ Bank	Foreign Banks in India	Non-Listed
FBI59	United Overseas Bank Ltd.	Foreign Banks in India	Non-Listed
FBI60	Westpac Banking Corporation	Foreign Banks in India	Non-Listed
FBI61	Woori Bank	Foreign Banks in India	Non-Listed
IPSB01	Axis Bank Ltd	Indian Private Sector Banks	Listed
IPSB02	Bandhan Bank Limited	Indian Private Sector Banks	Listed
IPSB03	Bank of Punjab	Indian Private Sector Banks	Listed
IPSB04	Centurion Bank Limited	Indian Private Sector Banks	Non-Listed
IPSB05	Centurion Bank of Punjab Limited	Indian Private Sector Banks	Listed
IPSB06	DCB Bank Limited	Indian Private Sector Banks	Listed
IPSB07	Global Trust Bank Limited	Indian Private Sector Banks	Listed
IPSB08	HDFC Bank Limited	Indian Private Sector Banks	Listed
IPSB09	ICICI Bank Limited	Indian Private Sector Banks	Listed
IPSB10	IDFC First Bank Limited	Indian Private Sector Banks	Listed
IPSB11	Indusind Bank Limited	Indian Private Sector Banks	Listed
IPSB12	Kotak Mahindra Bank Limited	Indian Private Sector Banks	Listed
IPSB13	Yes Bank Limited	Indian Private Sector Banks	Listed
IPSB14	Bank of Madura	Indian Private Sector Banks	Listed
IPSB15	Bank of Rajasthan Limited	Indian Private Sector Banks	Listed
IPSB16	City Union Bank Limited	Indian Private Sector Banks	Listed
IPSB17	Dhanlaxmi Bank Limited	Indian Private Sector Banks	Listed
IPSB18	Federal Bank Limited	Indian Private Sector Banks	Listed
IPSB19	ING Vysya Bank Limited	Indian Private Sector Banks	Listed

DMU Name/Coding	Bank	Ownership Category	Listing Status
IPSB20	Jammu & Kashmir Bank Limited	Indian Private Sector Banks	Listed
IPSB21	Karnataka Bank Limited	Indian Private Sector Banks	Listed
IPSB22	Karur Vysya Bank	Indian Private Sector Banks	Listed
IPSB23	Lakshmi Vilas Bank Limited	Indian Private Sector Banks	Listed
IPSB24	Nedungadi Bank	Indian Private Sector Banks	Listed
IPSB25	RBL Bank Limited	Indian Private Sector Banks	Listed
IPSB26	South Indian Bank Limited	Indian Private Sector Banks	Listed
IPSB27	Tamilnad Mercantile Bank Limited	Indian Private Sector Banks	Listed
IPSB28	United Western Bank Limited	Indian Private Sector Banks	Listed
IPSB29	Vysya Bank	Indian Private Sector Banks	Listed
IPSB30	Benares State Bank	Indian Private Sector Banks	Non-Listed
IPSB31	Bharat Overseas Bank Limited	Indian Private Sector Banks	Non-Listed
IPSB32	CSB Bank Limited	Indian Private Sector Banks	Non-Listed
IPSB33	Ganesh Bank of Kurundwad Limited	Indian Private Sector Banks	Non-Listed
IPSB34	Lord Krishna Bank Limited	Indian Private Sector Banks	Non-Listed
IPSB35	Nainital Bank Limited	Indian Private Sector Banks	Non-Listed
IPSB36	Sangli Bank Limited	Indian Private Sector Banks	Non-Listed
IPSB37	SBI Commercial and Internaltional Bank	Indian Private Sector Banks	Non-Listed
PSIB01	Allahabad Bank	Public Sector Indian Banks	Listed
PSIB02	Andra Bank	Public Sector Indian Banks	Listed
PSIB03	Bank of Baroda	Public Sector Indian Banks	Listed
PSIB04	Bank of India	Public Sector Indian Banks	Listed
PSIB05	Bank of Maharashtra	Public Sector Indian Banks	Listed
PSIB06	Canara Bank	Public Sector Indian Banks	Listed
PSIB07	Central Bank of India	Public Sector Indian Banks	Listed
PSIB08	Corporation Bank	Public Sector Indian Banks	Listed
PSIB09	Dena Bank	Public Sector Indian Banks	Listed
PSIB10	Indian Bank	Public Sector Indian Banks	Listed

DMU Name/Coding	Bank	Ownership Category	Listing Status
PSIB11	Indian Overseas Bank	Public Sector Indian Banks	Listed
PSIB12	Oriental Bank of Commerce	Public Sector Indian Banks	Listed
PSIB13	Punjab & Sind Bank	Public Sector Indian Banks	Listed
PSIB14	Punjab National Bank	Public Sector Indian Banks	Listed
PSIB15	Syndicate Bank	Public Sector Indian Banks	Listed
PSIB16	UCO Bank	Public Sector Indian Banks	Listed
PSIB17	Union Bank of India	Public Sector Indian Banks	Listed
PSIB18	United Bank of India	Public Sector Indian Banks	Listed
PSIB19	Vijaya Bank	Public Sector Indian Banks	Listed
PSIB20	IDBI Bank Limited	Public Sector Indian Banks	Listed
PSIB21	Bharatiya Mahila Bank	Public Sector Indian Banks	Non-Listed
SBIG01	State Bank of Bikaner and Jaipur	State Bank of India Group Banks	Listed
SBIG02	State Bank of India	State Bank of India Group Banks	Listed
SBIG03	State Bank of Mysore	State Bank of India Group Banks	Listed
SBIG04	State Bank of Travancore	State Bank of India Group Banks	Listed
SBIG05	State Bank of Hyderabad	State Bank of India Group Banks	Non-Listed
SBIG06	State Bank of Indore	State Bank of India Group Banks	Non-Listed
SBIG07	State Bank of Patiala	State Bank of India Group Banks	Non-Listed
SBIG08	State Bank of Saurashtra	State Bank of India Group Banks	Non-Listed